

Nutr 245: Medical Nutrition Therapy: A Case Study Approach 3rd ed.
Case 23 – Type 2 Diabetes Mellitus

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Instructions: This is not a group case study; it is an individual assignment! Complete the following questions using the background information of Case 23 (pages 79-85).

Remember RD's are experts in researching evidence-based practice for their patients so you can use other *credible* sources. *Be sure to reference your answers and provide a Work Cited page at the end.*****

I. Understanding the Disease and Pathophysiology

1. What are the risk factors for development of type 2 diabetes mellitus? What risk factors does Mrs. Douglas present with?

Risk factors for developing type 2 diabetes include increased age, obesity, family history, history of gestational diabetes mellitus, impaired glucose metabolism, physical inactivity, as well as being of certain ethnicities such as Hispanic, American Indian, or Native American.

Mrs. Douglas is 71 (elderly), she is obese (BMI of 30.3), she has a family history (she has a sister with it), blood glucose of 325mg/dL, no mention of any physical activity, and she is African American.
(Nelms page 498)

2. What are the common acute complications associated with type 2 diabetes mellitus? What are the chronic complications? Describe the pathophysiology associated with the chronic complications, specifically addressing the role of chronic hyperglycemia.

Common acute complications include diabetic ketoacidosis, the somogyi affect, the dawn phenomenon, hyperglycemic hyperosmolar syndrome, hyperglycemia, and hypoglycemia. One chronic complication of type 2 diabetes is cardiovascular disease. This occurs because the high blood glucose damages the nerve tissues and the blood vessels. The blood vessels can lose their elasticity. High glucose can start up the inflammatory process leading to cardiovascular problems such as heart attack. Other chronic complications of type 2 diabetes are retinopathy and nephropathy, which are caused by glucose damaging the tissues and vessels of the eyes and nephrons of the kidneys. Neuropathy occurs when there is nervous system damage which results in tingling and numbness of limbs, and can eventually lead to the need for limb amputation. It can also cause gastroparesis and sexual impotence. Glucose sticks to proteins in the blood causing damage and buildup. Chronic hyperglycemia is the ultimate cause for these three chronic complications (retinopathy, nephropathy, and neuropathy).

(Nelms page 486-487)

3. Here are four features of the physician's physical examination as well as her presenting signs and symptoms that are consistent with her admitting diagnosis. Describe the pathophysiology that might be responsible for each physical finding.

Physical Finding	Physiological Change/Etiology
Unhealed ulcer on foot	Neuropathy, resulting in the tingling and numbness in her foot. The ulcer could have been formed due to poor circulation. She was probably unaware that the ulcer was there so did not treat it right away. The immune response to heal the ulcer is also probably delayed due to an increase in counterirregulatory hormones
Frequent bladder infections	There is an increase in counterirregulatory hormones with the high glucose levels. This impairs the immune response
Tingling & numbness in feet	Neuropathy, the high glucose levels have caused damage to her nerves and poor circulation

Physical Finding	Physiological Change/Etiology
Blood glucose 325 mg/dL	In type 2 DM, tissues are insulin resistance, therefore the insulin is not able to work to keep glucose levels in a normal range.
HTN	Hyperglycemia causes thickening and decreased flexibility of the blood vessels which increases blood pressure
Retinopathy	High glucose causes damage to eye tissues

4. Briefly describe hyperglycemic hyperosmolar nonketotic syndrome (HHNS). How is this syndrome different from ketoacidosis?

HHNS is characterized by blood glucose levels of over 600 mg/dL, serum osmolality of over 320 mOsm/kg of water, and absence of significant ketoacidosis. It often goes along with infection and dehydration. Symptoms are similar to moderate hyperglycemia. There is adequate insulin to prevent lipolysis and ketogenesis but inadequate to maintain normoglycemia. HHNS is different from ketoacidosis in that it occurs most often with type 2 diabetes while ketoacidosis occurs mostly in type 1 DM. HHNS develops slowly unlike ketoacidosis which develops rapidly. HHNS has a much higher plasma glucose than ketoacidosis which has a plasma glucose of over 250 mg/dL. The serum bicarbonate in those with HHNS is over 15 mEq/L, and in ketoacidosis it is under 10-18 mEq/L.

(Nelms page 503)

5. What factors may lead to HHNS? Is Mrs. Douglas at risk?

Causes of HHNS are dehydration from inadequate fluid intake or excess fluid losses and prolonged hyperglycemia. Mrs. Douglas is at risk because of her hyperglycemia. Since her HbA1C is high, this indicates she has probably been hyperglycemic for at least a couple of months. If she does not get this under control, her risk will be even higher.

(Nelms page 503)

6. What is the immediate aim of treatment for HHNS? If HHNS is not treated, how would you expect the condition of HHNS to progress?

If HHNS is due to dehydration, there is hospitalization for slow rehydration. Treatment is needed for underlying medical problems, and insulin may or may not be required to adequately reduce hyperglycemia. If this is untreated, dehydration can lead to coma and become life threatening.

(Mayo Clinic)

II. Nutrition Assessment

A. Evaluation of Weight/Body Composition

7. Calculate Mrs. Douglas's body mass index (BMI). What are the health implications for a BMI in this range?

$$\text{BMI} = \text{weight (lbs)} / [\text{height (in)}]^2 \times 704.5$$

$$155/60^2 \times 704.5 = 30.3$$

This indicates that Mrs. Douglas is obese which puts her at high risk for many different health complications such as diabetes and cardiovascular disease.

(Nelms page 48)

B. Calculation of Nutrient Requirements

8. Calculate Mrs. Douglas's energy needs using the Mifflin-St. Jeor equation. (HINT: use actual weight and an AF and an IF)

$$10W + 6.25H - 5\text{age} - 161$$

$$10(70.3) + 6.25(152.4) - 5(71) - 161 = 1101.4$$

$$1101.4 \times 1.3(\text{AF}) \times 1.2(\text{IF}) = 1718.1884$$

9. Calculate Mrs. Douglas's protein needs. (HINT: remember she has an infection and needs to heal a wound)

1.4 g/kg body weight

70.3 kg body weight = 98.42g protein/day

Mrs. Douglas has increased protein needs because she is elderly and has an infection that needs healing.
(Nelms page 61)

10. Is the hospital diet order of 1,200 kcal appropriate? Explain why or why not?

1200 kcal is not an appropriate diet order at this time. While it may be appropriate to put her on this calorie restriction if trying to get her to lose weight, right now the first priority is healing her wound and her infection, so it may be appropriate to consume the needed 1718kcal/day as calculated by the Mifflin-St. Jeor. Once she is healed, it would be a good idea for her to go on a diet for weight loss since she is considered obese according to her BMI. 1200 kcal would be appropriate since it is about a 500 kcal per day decrease in calories which would lead to a recommended weight loss of 1-2 lbs per week.

C. Intake Domain

11. Using a computer dietary analysis program or food composition table, calculate the kcalories, protein, fat, CHO, fiber, cholesterol, and Na content of Mrs. Douglas's diet. Fill-in the blanks.

kcal = 1432.37; compared to kcal needs of 1718kcal (83.3% of needs)

protein = 44.03g and 12.2% kcal; compared to protein needs of 98.42g (45% of needs)

fat = 84.85g and 52.7% kcal; compared to fat needs of 30-35% kcal

Saturated fat = 32.37g and 20.1% kcal; compared to SFA needs of less than 7% kcal

CHO = 127.06g and 35.1% kcal; compared to CHO needs of 45-50% kcal

What about consistency of CHO at mealtimes?

Not consistent. She consumed 14.91g at breakfast, 31.12g at lunch, 72.22g at dinner, and 8.8g at her evening snack.

fiber = 20.77g; compared to fiber needs of 25-40g (83% of needs)

chol = 369.08mg; compared to cholesterol needs of less than 300 mg (81%% of needs)

Na = 3514.58mg; compared to Na needs of less than 2300mg (153% of needs)

12. From the information gathered within the intake domain, list key nutrition problems using the diagnostic term.

Inadequate energy intake

Excessive fat intake

Less than optimal intake of types of fats (saturated fat)

Inadequate protein intake

Inadequate carbohydrate intake

Excessive mineral intake of sodium

D. Clinical Domain

13. Compare the patient's laboratory values that were out of range on admission with normal values. How would you interpret this patient's labs? Make sure explanations are pertinent to this situation.

<i>Parameter</i>	<i>Normal Value</i>	<i>Patient's Value</i>	<i>Reason for Abnormality</i>	<i>Nutritional Implications</i>
<i>Glucose (mg/dL)</i>	70-110 mg/dl	325 mg/dl	diabetes	Eating a healthy diet, spread out carbs through the day
<i>HbA_{1c} (%)</i>	3.9-5.2%	8.5%	Diabetes, high blood glucose over last couple of months	Keep glucose levels under control, count carbs

Parameter	Normal Value	Patient's Value	Reason for Abnormality	Nutritional Implications
<i>Cholesterol (mg/dL)</i>	120-199 mg/dl	300 mg/dl	Poor diet, diabetes, increased risk for heart disease	Decrease saturated fat, increase mono and polyunsaturated
<i>LDL-cholesterol (mg/dL)</i>	<130 mg/dl	140 mg/dl	High saturated fat diet, diabetes, increased risk for heart disease	Decrease saturated fat
<i>HDL-cholesterol (mg/dL)</i>	>55 mg/dl	35 mg/dl	Diabetes, increased risk for heart disease	Healthy diet, increased exercise
<i>Triglycerides (mg/dL)</i>	35-135 mg/dl	400 mg/dl	Type 2 diabetes, increased risk for heart disease	Healthy diet, increased exercise

(Labtestsonline.org)

14. Why wasn't HbA_{1c} measured at discharge?

HbA_{1c} was not measured at discharge because this measurement shows the blood glucose levels going back 2-3 months. If another measurement was taken, there would most likely be no difference.

(Labtestsonline.org)

15. Compare the pharmacologic differences among the oral hypoglycemic agents.

Class	Generic/Brand Name	Mechanism of Action	Side Effects & Contraindications
<i>α-Glucosidase inhibitors</i>	Acarbose, Migitol, Voglibose/Precose, Glyset, Volix	Delays intestinal absorption of glucose	Flatulence, diarrhea, less efficacy frequent dosing, contraindicated with those with intestinal diseases, must take with meals 3 times/day
<i>Biguanides</i>	Metformin/Glucophage	Decreases hepatic glucose production, increases insulin uptake in muscles	Transient diarrhea, nausea, bloating, anorexia, flatulence, lactic acidosis (rare); contraindicated in those with renal insufficiency, liver failure, or treated CHF
<i>Meglitinides</i>	Repaglinade, Nateglinade/ Prandin, Starlix	Stimulates insulin secretion in presence of glucose, short acting	Hypoglycemia, requires frequent dosing, expensive
<i>Sulfonylureas First generation</i>	Acetohexamide, Chlorpropamide, Tolazamide, Tolbutamide/ Dyemelor, Diabinese, Tolinase, Orinase,	Stimulates insulin secretion	contraindicated in those with renal insufficiency, weight gain
<i>Second generation</i>	Glipzide, Glipzide-GITS, Glyburide, Glimepride/ Glucotrol XL, Diabeta, Micronase, Pres Tab, Glynase, Amaryl	Stimulates insulin secretion	Hypoglycemia (more with glyburide), contraindicated in those with renal insufficiency, weight gain
<i>Thiainedionesolid</i>	Pioglitazone, Rosiglitazone/ Actos, Avandia	Decreases insulin resistance	Weight gain, edema, worsened CHF, most expensive, slow onset of action, contraindicated in those with CHF

(Nelms pg 504-505)

- 16. From the information gathered within the clinical domain, list possible nutrition problems using the diagnostic term.**

Overweight/Obesity

Altered nutrition related lab values (Glucose, HbA1c, Cholesterol, LDL-cholesterol, HDL-cholesterol, Triglycerides)

E. Behavioral–Environmental Domain

- 17. Identify at least three factors that may interfere with Mrs. Douglas's compliance and success with her diabetes treatment. Within this domain, list possible nutrition problems.**

Mrs. Douglas is following 10 year old advice from her sister's doctor to avoid all starchy foods. She is consuming a very high fat diet. She lives in a low income household which could limit the groceries she is able to purchase.

Possible problems:

Food and nutrition related knowledge deficit

Undesirable food choices

Physical Inactivity

Limited Access to food and/or water

III. Nutrition Diagnosis

- 18. Select two high-priority nutrition problems and complete the PES statement for each.**

Obesity related to food and nutrition related knowledge deficit as evidenced by BMI of 30.3 (obesity class 1) and overconsumption of high fat food.

Undesirable food choices related to lack of prior exposure to accurate nutrition related information as evidenced by poor lipid panel (cholesterol of 300 mg/dl, LDL of 140 mg/dl, HDL of 35 mg/dl, and triglycerides at 400 mg/dl) and estimated intake inconsistent with nutrition prescription.

IV. Nutrition Intervention

- 19. Write Nutrition Prescription for patient. Include Diet type, kcal level, and key components from the CHO consistent diet.**

CHO consistent diet, 1718 kcal, consistent carbohydrates at all three meals, HS snack with carbohydrate count of half of that at meals

- 20. For each of the PES statements that you have written, establish an ideal goal (based on the signs and symptoms) and an appropriate intervention (based on the etiology). Use IDNT manual to label Intervention domains and subclasses; and give details of exactly what you are going to do.**

PES #1 Food and/or nutrient Delivery: Meals and Snacks: Composition of meals/snacks

- o Goal: Lose weight at a rate of 1-2 pounds per week to bring weight back to healthy range
- o Intervention: Encourage patient to decrease the consumption of foods with high levels of saturated fat and to concentrate on getting her carbohydrate levels of her meals consistent.

PES #2 Nutrition Education- Content

- o Goal: Bring lipid panel levels back to normal and evenly distribute carbohydrate servings throughout the day
- o Intervention: Education on how to properly eat for diabetes. Teach Mrs. Douglas that it is not necessary to avoid all carbohydrates, but to eat healthy sources of carbohydrates and spread out carbohydrates evenly throughout the day.

- 21. Write a concise ADIME note by pulling the key components from you answers. Consider the admission data only (not the 3 and 6 month data). Hand in typed version only.**

Nutrition Assessment

12/4/2012

1130

A: Pt. is 71 y.o. African American female, 5', 155#, BMI 30.3, IBW 100#, homemaker, cares for 80 y.o. sister, lives in low income apartment, pt complains of frequent bladder infections, unhealed 2-3cm ulcer on lateral left foot, blurry vision, PMH HTN, Takes 50 PO bid Capoten, sister has had diabetes for 10 years, avoids all starchy foods as told by sister's doctor 10 years ago, DX cellulitis, type 2 DM, current oral intake meeting 83% kcal needs, 57% protein needs, 109% fat needs, and 56% CHO needs

Lab values on admission: Glucose 325 mg/dl, BUN 26 mg/dl, chol 300 mg/dl, HDL-C 35 mg/dl, LDL 140 mg/dl, TG 400 mg/dl, HB A1c 8.5%

D: Obesity related to food and nutrition related knowledge deficit as evidenced by BMI of 30.3 (obesity class 1) and overconsumption of high fat food.

Undesirable food choices related to lack of prior exposure to accurate nutrition related information as evidenced by poor lipid panel (cholesterol of 300 mg/dl, LDL of 140 mg/dl, HDL of 35 mg/dl, and triglycerides at 400 mg/dl) and estimated intake inconsistent with nutrition prescription.

I: Nutrition Prescription: CHO consistent diet, 1718 kcal, consistent carbohydrates at all three meals, HS snack with carbohydrate count of half of that at meals

Food and/or nutrient Delivery: Meals and Snacks: Composition of meals/snacks

Goal: Lose weight at a rate of 1-2 pounds per week to bring weight back to healthy range

Encourage patient to decrease the consumption of foods with high levels of saturated fat and to concentrate on getting her carbohydrate levels of her meals consistent.

Nutrition Education- Content

Goal: Bring lipid panel levels back to normal and evenly distribute carbohydrate servings throughout the day

Intervention: Education on how to properly eat for diabetes. Teach Mrs. Douglas that it is not necessary to avoid all carbohydrates, but to eat healthy sources of carbohydrates and spread out carbohydrates evenly throughout the day.

M/E: Monitor saturated fat intake

Outcome: Patient with decrease saturated fat intake to less than 7% of kcal, will monitor 24 hour recall at follow up.

Monitor carbohydrate intake

Outcome: Patient will eat consistent carbohydrate diet. Will order for hospital stay and monitor at follow up after discharge.

Anthropometric measurements: Weight

Outcome: Pt will lose 1-2 lbs per week. Will measure at follow up.

Monitor Biochemical Data

Outcome: Lipid profile will return to normal levels as diet improves. Will monitor at follow up.

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Works Cited

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2. "Labtestonline.org." *Labtestonline.org*. N.p., n.d. Web. 27 Nov. 2012. <<http://labtestonline.org>>.
3. Nelms, Marcia Nahikian. *Nutrition therapy and pathophysiology*. 2nd ed. Belmont, CA: Wadsworth, Cengage Learning, 2011. Print.